UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/771,049	01/26/2001	Douglas Elmer Wallace JR.	16356.581 (DC-02749)	7240

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HAYNES AND BOONE, LLP
901 MAIN STREET, SUITE 3100
DALLAS, TX 75202

EXAMINER
GARCIA OTERO, EDUARDO

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 05/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.		Applicant(s)
Office Action Summary	09/771,049		WALLACE, DOUGLAS ELMER
	Examiner		**Art Unit**
	Eduardo Garcia-Otero		2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>07 November 2002 and 29 March 2002</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-22</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-22</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2</u>.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION: Non-Final (first action on the merits)

Introduction

1. Title is: Computer system and printed circuit board manufactured in accordance with a quasi-Monte Carlo simulation technique for multi-dimensional spaces.

2. First named inventor is: Wallace.

3. Claims 1-22 have been submitted, examined, and rejected. Claims 1, 10, 11, 20, 21, and 22 are independent.

4. US application filed 1/26/2001, no earlier priority is claimed.

Index of Prior Art

5. **Traub** refers to US patent 6,058,377.

6. **Chudnovsky** refers to US patent 6,381,669.

7. **Miller** refers to US patent 6,539,531.

8. **Niederreiter** refers to "Some Linear and Nonlinear Methods for Pseudorandom Number Generation", by Harald Niederreiter, Proceedings of the 1995 Winter Simulation Conference, pages 250 to 254

Request for Information

9. Specification page 2 line 30 states **"The quasi-Monte Carlo method is a relatively new method (ca 1992)"**, apparently referring to a 1992 paper by Harald Niederreiter titled "Random Number Generation and Quasi-Monte Carlo Methods, CBMS-NSF Regional Conference Series in Applied Math., Vol. 63, Soc. Industr. Applied Math., Philadelphia, 1992, vi + 241 pp. (1995 Outstanding Simulation Publication Award). Said paper is also mentioned in the Traub patent at column 3 line 43. The Examiner is unable to obtain said paper, and requests a copy from the Applicant, if available.

Drawings-color

10. Color photographs and color drawings are acceptable only for examination purposes unless a petition filed under 37 CFR 1.84(a)(2) is granted permitting their use as acceptable drawings. In the event that applicant wishes to use the drawings currently on file as acceptable drawings, a petition must be filed for acceptance of the color photographs or color drawings as acceptable drawings. Any such petition must be accompanied by the appropriate fee set forth in 37 CFR 1.17(h), three sets of color drawings or color photographs, as appropriate,

and an amendment to the first paragraph of the brief description of the drawings section of the specification which states: The patent or application file contains at least one drawing executed in color. Copies of this patent or patent application publication with color drawing(s) will be provided by the U.S. Patent and Trademark Office upon request and payment of the necessary fee. Color photographs will be accepted if the conditions for accepting color drawings have been satisfied.

11. In the Examiner's opinion, the use of color is not essential for these drawings.

Specification-objections-informalities

12. The Specification is objected to because of the following informalities. Appropriate correction is required.

13. The equations at specification page 5 lines 9-20 discuss generating a pseudo-random number "R" with a value between 0 and 1. However, for example, if the initial value of x is zero (or 000000000000 as a 16-bit number), then the first value of R appear to be $1/(2^{16})$. If x increments to a maximum value of 1111111111111 as a 16-bit number, then R will increment until a maximum value of $1 - 1/(2^{16})$. Apparently x will roll over to 000000000000 if it increments again, although this is not stated.

14. Thus, R does not appear to be a pseudo-random number, but rather appears to be merely a normalization of a 16 bit number into the range of 0 to almost 1, or more precisely from 0 to $1 - 1/(2^{16})$.

15. Note that incrementing x by 1 does <u>not</u> appear to generate a next quasi-Monte Carlo number, but rather appears to merely increment the previous R by $1/(2^{16})$.

35 USC § 101-statutory subject matter

16. 35 U.S.C. 101 reads as follows: Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

17. **Claims 1-22 are rejected under 35 U.S.C. 101** because the claimed invention is directed to non-statutory subject matter. Specifically, the claims are directed towards manipulation of an abstract idea (creating geometric models), without producing "useful, concrete, and tangible" results as required by *In re Alappat*, 33 F.3d 1524, 1544, 31 USPQ2d 1545, 1557 (Fed. Cir. 1994). An additional limitation in the independent claims using the simulated multi-

dimensional space for a "useful, concrete, and tangible" purpose would satisfy the requirements of 35 USC 101. See MPEP 2106(II)(A).

18. Additionally, regarding claim 9, 10, 19, 20, and 21, it is not clear what utility is gained by the formula for deriving possible values of s, and is not clear what utility is gained by the negative limitations excluding some possible values of s. See indefiniteness rejections below for further discussion. Further, note the discussion of base selection at specification page 3 lines 6-12, stating that base numbers of 2, 3, and 5 are often used for 3-dimensional work. Please clarify the specification page 3 line 8 term "non-random correlations".

35 USC § 112- first paragraph- enablement

19. The following is a quotation of the first paragraph of 35 U.S.C. 112: The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

20. **Claims 1-22 are rejected under 35 U.S.C. 112, first paragraph,** as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

21. Claims 1-22 require generating pseudo-random numbers. The specification does not adequately describe said generation. See above objections to specification.

22. Also, claims 9, 10, 19, 20, 21 and 22 state: "deriving the value of S such that a ratio r, as defined by $r = s^D/P^N$, is not factorable by one of the following selected from the group consisting of base P and the number of dimensions D, and where N is the number of pseudo-random numbers and r is a prescribed prime number".

23. Note that solving for s yields: $s = (rP^N)^{1/D}$.

24. It is not clear how or why said negative limitations prevent "very non-random correlations" according to specification page 3. Please clarify.

35 USC § 112-Second Paragraph-indefinite claims

25. The following is a quotation of the second paragraph of 35 U.S.C. 112: The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

26. **Claims 2-5, 9-10, 12-15, and 19-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite** for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

27. The claims 2 and 12 term **"based upon a prescribed index"** is indefinite. It appears from the specification that applicant's intent may be to normalize the pseudo-random number into a range from 0 to almost 1, and to similarly normalize the domain of the dimensional space of interest to a range from 0 to almost 1. In that way a normalized pseudo-random number would properly map into the domain of interest.

28. The claim 3 and 13 term **"statistically analyzing the sampled multiple variables according to a prescribed error analysis"** is indefinite. First, the term "statistically analyzing" is not clear. Second, the term "sampled multiple variables" appears to intend "sampled points in the multi-dimensional space", but is not clear. Third, the term "according to a prescribed error analysis" is not clear. Note that FIG 4 discusses errors for a 3D simulation for determining Pi from a 3D sphere, but it is not clear what type of prescribed error analysis is intended for a 2 dimensional space, or a 4 dimensional space, or a D dimensional space where D is not equal to 3

29. The claim 4 and 14 term **"performing numerical integrations upon the sampled multiple variables"** is indefinite. Note that multiple random numbers are generated, and used to generate variable values, and thus to select specific points in multidimensional space. It is not clear exactly what is being integrated with respect to what.

30. The claim 5 and 15 term **"the index equal to a total combinations of dimensional value points TC times a respective pseudo-random number R"** is indefinite. The term "dimensional value points" is not defined. Further, the order of the operations (equal to, times) is not clear.

31. The claim 9, 10, 19, 20, 21 and 22 term **"deriving the value of S such that a ratio r, as defined by $r = s^D/P^N$, is not factorable by one of the following selected from the group consisting of base P and the number of dimensions D, and where N is the number of pseudo-random numbers and r is a prescribed prime number"** is not clear.

32. First, this term appears to be a negative limitation, not a positive limitation.

33. Second, it is not clear whether N is the number of pseudo-random generated numbers, or whether N is the number of points in the multi-dimensional space.

34. Third, r (a prime number) is only factorable by P if P is a prime number (or 1), and only factorable by N if N is a prime number (or 1). It is not clear if this is Applicant's intent.

35. Fourth, the term "not factorable by one of the following from the group consisting of" is not clear. It is not clear whether Applicant intends not factorable by D, and also not factorable by N.

36. Note that solving for s yields: $s = (rP^N)^{1/D}$, and apparently where r is prime number not equal to D and also not equal to N.

37. Note that D and N are generally large numbers for complex models, and thus highly unlikely to be prime numbers. See discussion at specification page 3.

38. Claim Rejections - 35 USC § 102(a)

39. The following is a quotation of 35 U.S.C. 102(a) which forms the basis for the rejections under this section in this Office action: (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

40. **Claims 1-8, and 11-18 are rejected under 35 U.S.C. 102(a).**

41. <u>Claim 1-8 and 11-18 are rejected</u> under 35 U.S.C. 102(a) as being anticipated by Applicant's Admissions.

42. Claim 1 is an independent "method for simulating multi-dimensional space" claim with 2 limitations.

43. [1]-**"generating a sequence of pseudo-random numbers according to a prescribed quasi-Monte Carlo model"** is disclosed by Applicant's Admission at specification page 2 line 30 "The quasi-Monte Carlo method is a relatively new method (ca. 1992) that generates a hard-coded point-cloud that substantially evenly covers the dimensional space".

44. Regarding admissions, MPEP § 2129 states "When applicant states that something is prior art, it is taken as being available as prior art against the claims". *In re Nomiya*, 509 F.2d 566, 184 USPQ 607, 611 (CCPA 1975) states "admissions...may be considered "prior art" for any purpose, including use as evidence of obviousness under § 103". *Constant v. Advanced Micro-Devices*, 848 F2d 1560, 1570, 7 USPQ2d 1057, 1063 (Fed. Cir. 1988), "[Applicant's] own admission during prosecution...is binding upon him". Additionally, U.S. Patent and

Trademark Office (USPTO), Formulating and Communicating Rejections Under 35 U.S.C. 1037 (Feb. 13, 1991) states when relying on an admission as evidence of obviousness, moreover, it is unnecessary to cite a corroborating reference to support the admission. Also see 37 C.F.R. § 1.104(c)(3).

45. [2]-"mapping each pseudo-random number R of the sequence of random numbers into multiple variables of unique values for the multi dimensional space, the multi-dimensional space including D dimensions, where D is a number" is disclosed by Applicant's Admission at specification page 3 lines 6-12 "quasi-Monte Carlo... indexed into the dimensional space... for 3-dimensional work"

46. In claim 2, **"assigning the unique values to each dimension based upon a prescribed index"** is disclosed by Applicant's Admission at specification page 3 line 7 "indexed into dimensional space".

47. In claim 3, **"sampling the multiple variables of the multi-dimensional space and statistically analyzing the sampled multiple variables according to a prescribed error analysis"** is disclosed by Applicant's Admission at specification page 3 line 1 "The quasi-Monte Carlo method error drops at almost the rate of 1/N for multiple dimensions, wherein doubling the samples halves the error."

48. In claim 4, **"sampling the multiple variables of the multi-dimensional space and performing numerical integrations upon the sampled multiple variables"** is disclosed by Applicant's Admission at specification page 3 line 1 "The quasi-Monte Carlo method error drops at almost the rate of 1/N for multiple dimensions, wherein doubling the samples halves the error."

49. In claim 5 there are three limitations, [1]-"generated by the prescribed quasi-Monte Carlo model includes a floating point number having a value between 0.0 and 1.0" disclosed by Applicant's Admission at specification page 3 line 7 "indexed into the dimensional space".

50. Second in claim 5, [2]-**"further wherein each dimension is characterized by a unique value based upon an index"** is disclosed by Applicant's Admission at specification page 3 line 7 "indexed into the dimensional space".

51. Third in claim 4, [3]-"**the index equal to a total combinations of dimensional value points TC times a respective pseudo-random number R**" is disclosed by Applicant's Admission at specification page 3 line 7 "indexed into the dimensional space".

52. In claim 6 there are three limitatioms, [1]-"**each of the multiple variables of the multi-dimensional space represents a corresponding D dimension value**" is disclosed by Applicant's Admission at specification page 3 line 7 "indexed into the dimensional space".

53. Second in claim 6, [2]-"**wherein each dimension is characterized by a minimum and a maximum value**" is disclosed by Applicant's Admission at specification page 2 line 8 "grid method". Note that a grid implies a maximum value, a minimum value, and a resolution for each dimension.

54. Third in claim 6, [3]-"**further wherein each dimension is characterized by a prescribed resolution S**" is disclosed by Applicant's Admission at specification page 2 line 8 "grid method". Note that a grid implies a maximum value, a minimum value, and a resolution for each dimension.

55. In claim 7 there are three limitations, [1]-"**the D dimension values are further characterized by a first dimension DO that includes minimum and maximum values defined as DO.min and DO.max, respectively**" is disclosed by Applicant's Admission at specification page 2 line 8 "grid method". Note that a grid implies a maximum value, a minimum value, and a resolution for each dimension.

56. Second in claim 7, [2]-"**a second dimension D1 that includes minimum and maximum values defined as D1.min and D1.max**" is disclosed by Applicant's Admission at specification page 2 line 8 "grid method". Note that a grid implies a maximum value, a minimum value, and a resolution for each dimension.

57. Third in claim 7, [3]-"**etceteras, up to a Dth dimension**" is disclosed by Applicant's Admission at specification page 2 line 8 "grid method". Note that a grid implies a maximum value, a minimum value, and a resolution for each dimension.

58. In claim 8, there are two limitations, [1]-"**selecting a value of S according to a desired accuracy of a final simulation value**" is disclosed by Applicant's Admission at specification page 2 line 8 "grid method" and specification page 3 line 1 "The quasi-Monte Carlo method error drops at almost the rate of 1/N for multiple dimensions, wherein doubling

the samples halves the error. This is very important in limiting the computations for medium to large dimensions." Note that a grid implies a maximum value, a minimum value, and a resolution for each dimension.

59. Second in claim 8, [2]-**"wherein the value of S defines a grid for use in conjunction with the mapping of the pseudo random numbers into the multiple variables of the multi-dimensional space"** is disclosed by Applicant's Admission at specification page 2 line 8 "grid method". Note that a grid implies a maximum value, a minimum value, and a resolution for each dimension.

60. Claims 9 is not rejected against prior art.

61. Claim 10 is an independent "simulating a multi-dimensional space" claim, and is not rejected against prior art.

62. Claims 11-18 are "method for simulating a trace impedance of a printed circuit board characterized by at least three dimensions of a multi-dimensional space" with exactly the same limitations as "method for simulating multi-dimensional space" claims 1-8 respectively, and thus are rejected for the same reasons respectively.

63. Claims 19-21 are not rejected against prior art.

Patentable material

64. At present, the Examiner believes that this application contains some potentially patentable material. Specifically, the negative limitations in claims 9, 10, 19, 20, 21 and 22 are not rejected against prior art. Said claims state: "deriving the value of S such that a ratio r, as defined by $r = s^D/P^N$, is not factorable by one of the following selected from the group consisting of base P and the number of dimensions D, and where N is the number of pseudo-random numbers and r is a prescribed prime number". **Note that solving for s yields: s = $(rP^N)^{1/D}$.**

65. Applicant appears to imply that said negative limitations may prevent or reduce "very non-random correlations" according to specification page 3.

66. If Applicant can overcome the relevant pending rejections, then said claims may contain patentable material.

67. Note that drawings may be a very efficient way to demonstrate "very non-random correlations", and also to demonstrate the absence of said "very non-random correlations"

when the negative limitation of claims 9, 10, 19, 20, 21 and 22 are enforced. For example, possibly Applicant's FIG 3 displays said non-random correlation, please discuss in detail. Said drawings may assist the Examiner in ascertaining the differences between the prior art and the claims at issue. See *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966).

68. Further, it appears that any such "non-random correlations" may also be related to or dependent upon the specific techniques used for generating the pseudo-random numbers. Thus, it is important to clarify the pseudo-random number generation algorithms discussed in at specification page 5 lines 9-20.

Additional Cited Prior Art

69. The following US patents or publications are hereby cited as prior art, but have not been used for rejection. Applicant should review these carefully before responding to this office action.

70. "Some Linear and Nonlinear Methods for Pseudorandom Number Generation", by Harald Niederreiter, Proceedings of the 1995 Winter Simulation Conference, pages 250 to 254 discloses "Two principal classes of methods for the generation of pseudorandom numbers" at Abstract.

71. Chudnovsky, US patent 6,381,669 discloses "certain known pseudo-random number generators may not uniformly map" at column 2 lines 48-49.

72. Truab, US patent 6,058,377 discloses "a multi-dimensional integral… low-discrepancy deterministic sequence of points in the multivariate unit cube… suitable transformation or mapping" at column 3 lines 7-17, and "Quasi-Mone Carlo Methods" at column 3 lines 43-52.

73. Miller, US patent 6,539,531 discloses "trace impedance" at column 13 line 45.

Conclusion

74. All pending claims stand rejected.

75. There may be some potentially patentable material in claims 9, 10, 19, 20, 21 and 22, regarding negative limitations for selecting the number of intervals.

Communication

76. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eduardo Garcia-Otero whose telephone number is 703-305-0857. The examiner can normally be reached on Tuesday through Friday from 9:00 AM to 8:00 PM. If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor,

Kevin Teska, can be reached at (703) 305-9704. The fax phone number for this group is
703-872-9306. Any inquiry of a general nature or relating to the status of this application or
proceeding should be directed to the group receptionist, whose telephone number is (703)
305-3900.

* * * *

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER